Synopsis for Pursuing Research for the Degree of Ph. D. in Computer Science

Proposed Topic

"Object Oriented Software System: A Study of Testing Techniques"

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Purpose of Study

We know that software has become the key element in the evolution of computer based systems and products. Software testing is a critical element of software quality assurance and represents the ultimate review of specification, design and coding. It is not unusual for a software development organization to expend between 30 to 40 percent of total project effort on testing. In the extreme testing of human rated software can cost three to five times as much as all other software engineering activities combined.

Currently there is a trend of developing Object Oriented Systems due to obvious reasons. Most research on Object Oriented paradigms has been focused on analysis, design and programming fundamentals. Testing the systems that are created with these paradigms has been considered and afterthought. Traditional testing techniques must be evaluated to determine their significance with respect to Object Oriented Systems, and further new techniques could be developed. There are several types of testing techniques, methods and ways available, in which some may be considered most efficient in respect of the testing of object oriented system. We would consider that there are some techniques, methods and ways, which may be most suitable for a particular type of applications like Object Oriented, Procedural, Web-based etc. This idea has motivated us to take up this study for investigation.

With this in view, we propose to study the testing of Object Oriented System. The purpose is to study the methods to determine the best way to perform object oriented testing in particular situation and class of application domains. It is expected that the proposed work would be at par with National and International Laboratories.

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Synopsis

TITLE: "Object Oriented Software System: A Study of Testing Techniques"

(A) Present State of Knowledge:

Morris S.Jhonson. Jr. [1] J.H.Hayes [3] presents a survey of research in testing Object Oriented systems, and they discussed the challenges to testing an Object Oriented System. They concluded that some Object Oriented systems do not conform to traditional testing definition or techniques. They presented several techniques for doing Object Oriented testing. They also examined the testing of object-oriented systems and compared it with the testing of conventional programming language systems, with emphasis on fault-based testing.

Huo Yan Chen et.al.[2] described that Object-oriented systems contain four different levels of abstraction i.e. algorithmic level, class level, cluster level, and system level. They presented a unified methodology TACCLE, for object-oriented software Testing at the Class and Cluster Levels.

Roel Wieringa [4] proposed that how object oriented specifications differs essentially from structured ones and pointed out opportunities for combining those two kinds of specifications.

M.J.Harrold and J.D.Mc Gregor [5] presented a class testing technique that exploits the hierarchical nature of the inheritance relation to test related groups of classes by reusing the testing information for a parent class to guide the testing of a subclass.

Thomas J.Cheatham and Lee Mellinger [6] described that it is possible to begin unit testing earlier in Object Oriented Programing System development as soon as a class is implemented. If the class is not a derived class, the unit testing is equivalent to unit testing in a traditional system

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David C Kung et.al.[7] Present an Object Oriented testing and maintenance Model and describe a supporting CASE environment.

M.Pezze and M.Young [8] emphasised on Object Oriented software requirements and adopted approaches to software test and analysis keeping in view the characteristics of object oriented software that impact test and analysis.

Y.Wang et.al [9] introduced a new philosophy contributing towards the design of testable object oriented software.

D.Jeffrey and Neelam Gupta [10] presented a new approach for test suite reduction that attempts to use additional coverage information of test cases to selectively keep some additional test cases in the reduced suites that are redundant with respect to the testing criteria used for suite minimization, with the goal of improving the Fault Detection Effectiveness (FDE) retention of the reduced suites.

C.Nebut et.al. [11] concentrated here on widely accepted practices based on the use of the Unified Modeling Language (UML) to support an object-oriented development process. They proposed a new approach for automating the generation of system test scenarios from use cases in the context of object-oriented embedded software

(B) Broad Outline of the Work:

The objective of this research will be to consider the possible techniques, methods and ways that may be most efficient in respect of testing of object oriented system. The following is the plan of research:

(I): Initially literature survey has to be done for collecting necessary Information on the following:

i) Structured Oriented Testing Techniques
ii) Object Oriented Testing Techniques
iii) Technical metrics for Object Oriented testing.
iv) Critical evaluation material on Object Oriented Analysis and Design.
v) Research papers on software testing of Object Oriented System and software metrics etc.

(II): The next phase will consist of consolidation of the above mentioned input to obtain the required research information for the further work.

(III): The aim of this phase will be to evaluate the traditional software testing technique to determine whether they are still useful with respect to Object Oriented Software.

(IV): This phase would try to identify the effect of Object Orientation on software testing. The comparison of testing technique of Structured and Object Oriented System will also be an interesting aspect.

(V): This phase analyze the testing techniques use for Object Oriented Systems in software development Industries.

(C) Preliminary work done on the lines:

I have already gone through the relevant literature during last one year. A few of the research texts are as follows:

i) Software Engineering:A Practitioner's Approach- Sixth Edition,. Roger S.Pressman, Mcgraw – Hill International Edition

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ii) Testing Object-Oriented Systems: Models, Patterns, and Tools (The Addison-Wesley Object Technology Series)

iii) An integrated approach to Software Engineering -Second Edition. Pankaj Jalote , Narosa Publication,2000

iv) Software Engineering,Ian Sommerville, Pearson Edition.

v) Software Engineering – Principles & Practice, Waman S Jawedkar, Tata Mcgraw-Hill publishing Company Limited,NewDelhi

In addition to the above texts, I am also in constant touch with the following research journals:

i) IEEE Software
ii) IEEE Transactions on Software Engineering
iii) IEEE Computer
iv) CSI (Computer Society Of India) Journals
v) Science Direct

(D) References:

[1] Morris S Johnson Jr., "A Survey of Testing Techniques for Object Oriented System" Internet.

[2] H.Y.Chen,T.H.Tse and T.Y.Chen, "TACCLE: A Methodology for Object Oriented Software Testing at the class and cluster levels" Transactions on Software Engineering and Methodology, Vol 10,No.4 January 2001 pp 56-109.

[3] Jane Huffman Hayes, "Testing of Object Oriented Programing Systems: A Fault Based Approach" Internet.

[4] Roel wieringa, "A Survey of Structured and Object Oriented Software specification methods and Techniques" ACM Computing Surveys,Vol.30, No 4,Dec1998.

[5] Mary Jean Harrold and John D.Mcgregor, "Incremental Testing of Object Oriented Class Structures" Internet.

[6] Thomas J.C. and lee Mellinger, "Testing Object Oriented Software System",ACM 1990 pp 161-165

[7] David C Kung, Jarry Gao, Pei Hsia, "An Object Oriented Testing and Maintenance Environment" Internet.

[8] Mauro Pezze and Michal Young, "Testing Object Oriented Software" Internatinal Conference on Software Engineering 2004 IEEE.

[9] Y.Wang,G.King,I.Court,M.Ross and G.Staples, "On Testable Object Oriented Programing ", ACM SIGSOFT,Software Engineering Notes Vol.22 No.4 July 1997 pp 84-90.

[10] Dennis Jeffrey and Neelam Gupta, "Improving fault Detection Capability by Selectively Retaining Test Cases During Test Suite Reduction", IEEE Transactions on Software Engineering, Vol.33 No.2 pp 108-123 Feb 2007.

[11] C.Nebut,Frank Fleurey,Y.L.Traon and J.M.Jezequel, "Automatic Test Generation :A use case Driven Approach", IEEE Transactions on Software Engineering,Vol 32 No. 33 pp 140-155 March 2006.